Remarks

The Office Action and cited references, particularly the newly-cited Shane patent, have been reviewed with care in preparation for this amendment and response. Applicant submits that, based on the arguments below and the Rose declaration, the presently-pending claims are patentable. Applicant's claimed invention relates to an important advance in the field of annular pleated filter cartridges for liquid filtration, and the Examiner's review of this amendment and the accompanying papers is requested.

Applicant thanks the Examiner for her courtesy in granting the recent interview of May 22, 2002, and the earlier interview of December 5, 2001. The discussion with the Examiners was helpful in prosecution of this application, and this amendment and response are as indicated by the undersigned attorney during the Interview Summary of May 22, 2002. That is, applicant is now submitting the promised declaration under 37 CFR §1.131 and is presenting arguments with respect to the combination of references (Shane in view of Marshall et al.) to show the non-obviousness of the claimed invention. Applicant believes that, as now presented, this application is in condition for allowance.

As already noted above, required steps have been taken to correct inventorship. More specifically, it has been determined that Stephen W. Rose is sole inventor, rather than being one of two co-inventors. The papers supporting the petition include (1) the required statement signed by Steven L. Hughes, who, as now determined is *not* co-inventor with Rose, (2) the required statement signed by the assignee corporation (Oberlin Filter Company), and (3) the declaration of Stephen W. Rose as sole inventor. During the investigation in connection for preparing papers under 37 CFR §1.131, it became apparent that such correction was needed.

Turning now to details of the PTO action of February 15, 2002, claims 16 and 26 were objected to under 37 CFR §1.75 as substantially duplicates of claims 15 and 25, respectively. Applicant has cancelled claims 16 and 26, thus overcoming this objection.

Claims 1-2, 4-13, 18, 20, 22-23 and 28-29 were rejected as unpatentable over the Shane patent in view of PCT Patent Publication WO98/07905 (Marshall et al.), under 35 USC §103(a). As earlier pointed out, the Marshall et al. patent publication, owned by DuPont (Wilmington,

Delaware), was acknowledged by applicant and is referenced in the instant patent application as relating to the Tyvek material of the claimed inventive annular pleated filter cartridge. Such rejection should be lifted based on the reasons given below.

Before commenting in detail on new points, applicant wishes to note that the argument in the Amendment of November 28, 2001 and its accompanying declaration of DuPont's Dr. Ernest Mayer, which deals *inter alia* with thickness, flow-through rates and particle-size ratings of *non-woven* filtration layers used in annular pleated filter cartridges, set forth nonobviousness grounds with respect to applicant's claimed invention. Such previously-submitted evidence and arguments are applicable despite the nature of the Shane reference. The Shane patent, because it deals with another point that is not related to applicant's invention, is quite *non-instructive* on particular points which bear on the instant invention.

Applicant submits that the pending claims are patentable for each of the following two reasons bearing on the outstanding rejection:

- First, as set forth in greater detail below, the content of the Shane reference is *not* such that Shane, taken with Marshall et al., would render obvious the claimed annular pleated filter cartridge of applicant's claims; and
- Second, applicant's invention *predates* the critical date of the Shane patent -- February 8, 1999, as established by the appended declaration under 37 CFR §1.131 and the significant supporting documents attached thereto.

Applicant believes that each of the two reasons is sufficient in itself to overcome the rejection. These points will now be discussed.

Non-obviousness Over
<u>Shane in View of Marshall et al.</u>

Applicant's claimed invention, as stated in each of his claims, relates to an improvement in annular pleated filter cartridges of the type including "an annular *non-woven* filter element." The claims relate to annular pleated filter cartridges with Tyvek, a particular *non-woven* material which is both very thin and flimsy -- and therefore contra-indicated for annular pleated filter

cartridges,[1] but which provide not only significantly enhanced filtering abilities based on high flow-through rates and particle-capturing advantages (as stated in claim 1, "having a pressure drop of less than 4 psid at a flow rate of 10 gal/hr and a filtration efficiency of at least 98% of 1-2 micron particles at a pressure differential of 30 psid"), but also provide other performance advantages which are very significant for annular pleated filter cartridges. As earlier pointed out clearly and specifically by Dr. Mayer giving specific reasons, the use of Tyvek in annular pleated filter cartridges is non-obvious.

It must be pointed out that the Shane patent does not specifically relate to cartridges necessarily having *non-wovens* of a particular thickness as the filter layer; i.e., it is at least very clear that Shane, in its discussion of filtering materials, does not correlate any particular thickness to any particular material -- particularly not to any non-woven filtering material. Thus, the Shane patent is *non-instructive* on particular points relevant to the instant invention. The fact that the thickness range given in Shane, which includes at its low end a thickness dimension at the uppermost end of applicant's preferred thickness range, does not teach *non-wovens* of that thickness for annular pleated filter cartridges.

A brief review of what the Shane patent is all about should be helpful in determining its effect in combination with Marshall et al.:

The Shane patent relates to a pleated cartridge assembly method involving a cylindrical "continuous *elastic* support sleeve" that encases "cylindrical pleated filter media," to use wording of Shane's claim 1. The Shane patent relates in particular to the "compressing" of the annular

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[1]As noted earlier, Tyvek is contra-indicated for pleated annular filter cartridges given specific problems/concerns of such products. On this point, attached Exhibit 1 is page 45 from the *Nonwovens World*, December 2000, which accurately states:

> The filtration industry is highly segmented due to the very large number of specialized filtration applications in the world. *Each application has its own set of problems that need resolution.* This has led to many types of filter media being developed for use in the industry. *Each material has a specific set of functions that makes it useful to meet an application end. No material can perform adequately in all applications.* (emphasis added)

pleated filter media and its "thereafter expanding"[2] against the inward force of the elastic support sleeve which has an inner dimension that is described as "smaller than the original outer dimension of said cylindrical media" (see claim 1) -- i.e., an interaction with the elastic support sleeve (a mesh) which is "elastically stretched" by the pleated filter media. It must be seen, that the Shane patent mainly speaks about the sleeve-media interaction and is quite *non-specific* insofar as examples of the pleated filter layer are concerned. In referring to the pleated filter layer, the *only* specific "preferred" example given is a "fiberglass" filtration layer (see column 3, lines 13-14). The lengthy list of recited materials for the filtration layer(s) is very general in nature and never makes specific reference to *non-wovens* of any *particular* thickness as the main filtration layer.

Indeed, it is only in discussing the support layers (*not* the filtration layer) that there *is* reference in the patent to the word "non-wovens." This is at column 4, lines 63-66, where Shane states, "Upstream and downstream *non-woven* support layers (e.g., polyester, nylon or hemp layers) can also be provided *on opposite sides of the filtration layer* to prevent damage to the filtration layer. (emphasis added) The absence in Shane of reference to non-woven filtration material of any particular thickness, in the face of reference to non-wovens as support layers, is significant -- in connection with the rejection of applicant's claims. Extremely thin non-wovens are not particularly mentioned; indeed, it should be seen that the filtration materials as listed could be films, membranes or otherwise. Shane in view of Marshall et al. simply does not render obvious applicant's claimed invention.

As was mentioned at the interview, the only *preferred* example given in the Shane patent has a "fiberglass" filtration layer (see column 3, lines 13-14). No particular thickness is specified for such fiberglass filtration layer; it could be in the thicker part of the range noted elsewhere in Shane. However, whether thicker or thinner it should be noted that fiberglass is known to be unlike Tyvek in characteristics that relate specifically to flimsiness -- the nature of Tyvek which

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[2]It can be noted that this "expanding" in itself at least appears to imply something of a *non-flimsy* characteristic of whatever filtering media (multi-layer or otherwise) may be used. The Tyvek material of applicant's claimed annular pleated filter cartridge is quite flimsy.

make it unobvious for annular pleated filter cartridges. Fiberglass typically has what could be referred to as more body or rigidity -- which is different than flimsiness.[3] More specifically, the fibers of fiberglass have about 100% crystallinity, while the crystallinity of the high-density polyethylene (HDPE) fibrils of Tyvek is much lower. And, the density of the glass fibers is nearly three times as great as the density of HDPE; i.e., the density of glass is about 0.090 lbs/in^3 while the density of HDPE is about 0.034 lbs/in^3. Given this relative rigidity, one would not take any teaching about thin fiberglass (even if it were taught) and draw particular implications about Tyvek. This point is merely supplemental to the point made above about the *non-specificness* of Shane on materials and thicknesses -- i.e., the fact that there is no correlation of specific thicknesses and specific filtration materials.

To summarize, based on Shane in view of Marshall et al. it would *not* have been obvious to use the Tyvek material in an annular pleated filter cartridge. As already noted, the particularly flimsy nature of such material made the claimed invention contra-indicated, and the disclosure in Shane is not sufficient to change this. Furthermore, the advantages provided by the claimed invention in the field of annular pleated filter cartridges are quite significant. These include, in addition to significantly enhanced filtering abilities for an annular pleated filter cartridge (including high flow-through rates and particle-capturing advantages for particles as small as 1-2 microns), the ability to have high pleat densities without concomitant flow-restriction or degradation problems, and various other advantages discussed earlier and in the patent application. With all this in mind, claims 1-2, 4-13, 18, 20, 22-23 and 28-29, the rejection with which we are now dealing, are patentable, including over Shane in view of Marshall et al.

Claims 14-17 and 24-27 were rejected as unpatentable over Shane in view of Marshall et al. and further in view of the Miller et al. patent, under 35 USC §103(a). Claims 16 and 26 were cancelled to eliminate an objection. Claims 14, 15, 17, 24, 25 and 27 are each directly or indirectly dependent on either independent claim 1 or independent claim 23. This rejection is

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[3]This is alluded to in a discussion of glass fibers on page 6-39 of *Handbook of Plastics and Elastomers*, Charles A. Harper (McGraw-Hill Books), referring to fabrics with fiberglass as having "resistance to flexing." Pertinent pages of this document are attached as Exhibit 2.

respectfully traversed in view of the foregoing discussion bearing on such independent claims. Therefore, such dependent claims are also patentable.

Swearing Behind Shane

Attached is the declaration of inventor Stephen W. Rose under 37 CFR §1.131 which, along with the attached supporting documents, shows in more-than-sufficient detail applicant's priority over the Shane patent, the critical date for which is February 8, 1999. The declaration speaks for itself and requires no discussion here.

* * * * *

The claims as presently amended are believed to be in condition for allowance. Early favorable action is earnestly solicited. The Examiner is invited to call the undersigned if such would be helpful in resolving any issue which might remain.

Respectfully submitted,

Peter N. Jansson
Registration No. 26,185

Dated: June 20, 2002

Jansson, Shupe & Munger, Ltd.
245 Main Street
Racine, WI 53403-1034
Attorney Docket No. OB-102US
Telephone: 262/632-6900
Telefax: 262/632-2257

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largest pore size. Figure 1 is a schematic of a screen and variously-sized particles that exist in a fluid stream. Larger particles are selectively removed from the fluid stream by the size of the openings in the screen. As the particles build one on top of another, as in the side view, they create a filter cake that removes successively smaller particles until the cake becomes plugged. The particles that stop flow through the filter cake are the smallest particles in the fluid stream. The pore size distribution is the controlling design criteria for how the media will work in the filter.

Impaction. Figure 2 is a schematic showing single fiber inertial interception. When a particle is in a fluid stream, it may leave the stream through its own inertia and impact against a fiber surface. If the particle is too large in comparison to the fiber diameter, it will bounce off the surface and will continue downstream through the filter medium until it is mechanically entrapped. If the particle is too small, it will follow the fluid streamlines around the fiber and not impact the fiber surface. If the particle is of the correct size range, it will leave the fluid stream, impact the fiber surface and stick to it. This mechanism is dependent on the relationship between the particle and fiber diameters, is a function of the face velocity of the fluid through the filter, and happens in both wet and dry filtration environments.

FILTER MEDIA DESIGN PHILOSOPHY

The filtration industry is highly segmented due to the very large number of specialized filtration applications in the world. Each application has its own set of problems that need resolution. This has led to many types of filter media being developed for use in the industry. Each material has a specific set of functions that makes it useful to meet an application need. No material can perform adequately in all applications.

Filter design philosophies have dictated various filter media needs. For example, multiple-use filters that are cleanable usually use layers of filter media that retard penetration of particulate into the depth of the material. These penetration-controlling materials may include laminated layers of microfibers, coatings of microporous collapsible foams and membranes.

Single-use filters have significant space limitations to maximize performance. Some of the filter design philosophies employed have led to marketable differences in filters for the same application that have helped filter companies to position the products away from direct competitors. In many cases, these differences have been accomplished by adding multiple layers of "specific purpose" materials to the filter design. Each layer has a defined purpose and location in the filter to accomplish its task. The purpose may be to protect a downstream layer by removing a fouling contaminant before it can reach the active layer. It may also act as a physical support for the upstream layers to reduce the chance for pressure burst issues. Since the construction and properties of wovens, paper and nonwovens are all different, each has its place in the filter designer's toolbag. Combining them together can generate some interesting synergistic effects in the filter application. The following examples will describe a

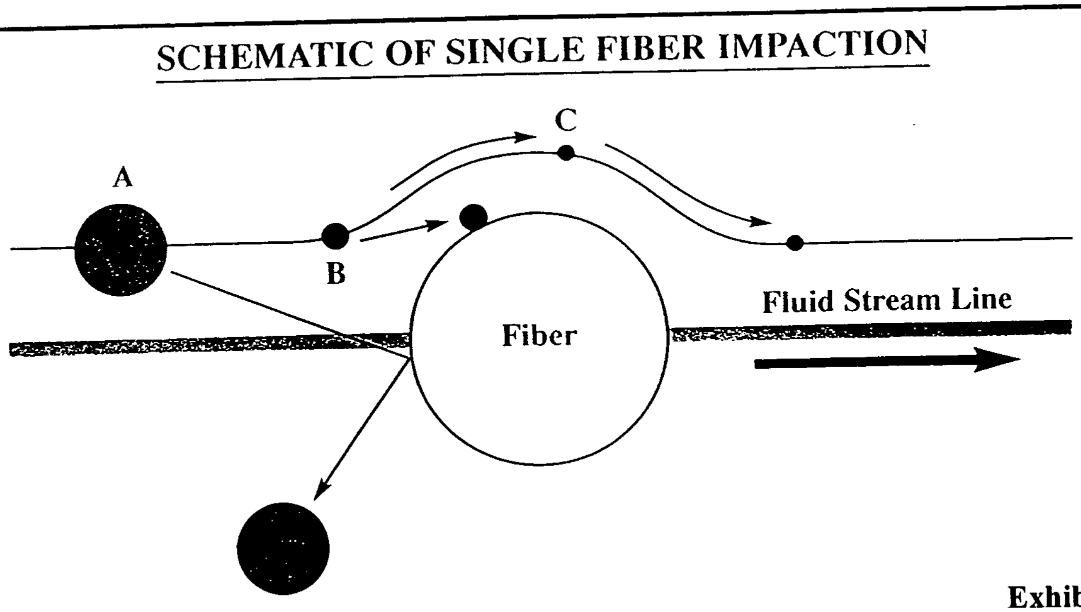

Exhibit 1

A = large particle bounces off fiber
B = target-size particle adheres to fiber
C = small particle follows stream line and avoids fiber

Figure 2

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CHARLES A. HARPER *editor-in-chief*
Westinghouse Electric Corporation
Baltimore, Maryland

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Exhibit 2

Glass

A manufactured fiber in which the fiber-forming substance is glass.

History In 1893, Edward D. Libbey made fiber-glass yarn which was used as a warp with a silk filling for a dress fabric at the Columbian Exposition in Chicago. Mr. Libbey was the founder of Libbey Glass Co. in Toledo, Ohio. His fiber-glass efforts, however, were premature from a commercial standpoint.

During World War I, the Germans made thermal insulation from fiber glass by the Gossler process. This process drew the fibers from the molten glass and collected them on a revolving drum.

Only very slow progress was made in fiber-glass technology until 1931. At about this time, Owens Illinois Co. in Columbus, Ohio, developed steam-blowing techniques for making glass fiber. The resulting material was used for air-filter media. During

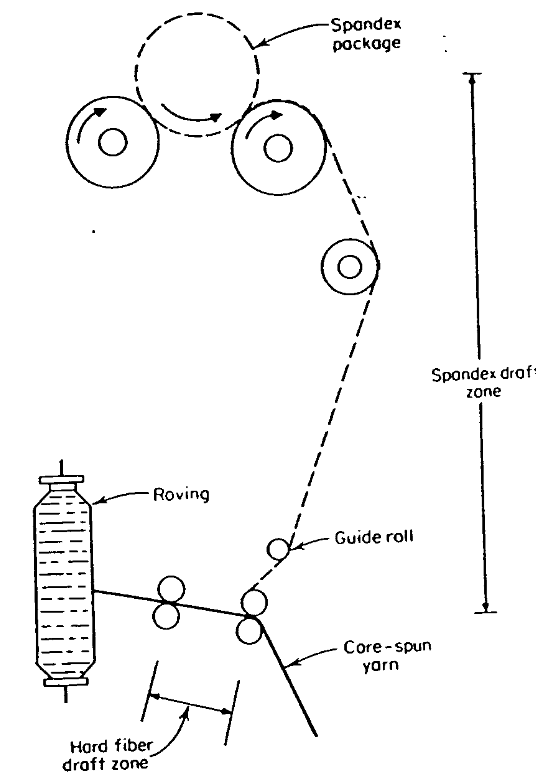

Fig. 11 Typical spandex core-spinning setup.[3]

the 1930s, air-drawing techniques were used for staple fiber-glass production. In 1936, Owens Illinois developed a continuous-filament drawing process for fiber glass. This process drew the streams of molten glass from small heated furnaces called "bushings," at speeds exceeding 2 mi/min.

The Corning Glass Co. was also producing glass fibers, and in 1938, Owens Illinois Co. and Corning Glass Co. pooled their efforts and formed the Owens Corning Fiberglas Corp. The products they produced were sold under the Fiberglas trademark. The first products sold were for air filtration, thermal insulation, and textile yarns for industrial use.

The first two types of yarns developed for textile use were the E type (glass suitable for electrical purposes) and the C type (glass resistant to chemical attack).

In the mid-1960s, Owens Corning Fiberglas achieved a breakthrough in the

development of very fine filaments for yarns in the range of 3.8 μm or ¼ denier. These yarns, designated "beta," enabled fiber glass to be used in textile structures which require softer fabrics, higher strengths, and resistance to flexing. They also enable items such as bedspreads and special products for aerospace applications such as astronauts' uniforms to be made from fire-resistant fiber glass.

Raw materials and manufacturing process The major ingredients for the E and C types of glass are listed in the following comparison. E glass is characterized by superior electrical properties and higher heat resistances; C glass can vary in composition according to the need for a variant to resist chemical action.

Composition	*E Glass, %*	*C Glass, %*
Silicon dioxide	52–56	60–65
Calcium oxide	16–25	
Aluminum oxide	12–16	2–6
Boron oxide	8–13	2–7
Sodium and potassium oxide	0–1	8–12
Magnesium oxide	0–6	
Magnesium oxide and calcium oxide	.....	15–20

The following five steps outline the basic methods of manufacturing glass yarns:

1. The basic ingredients are mixed and blended according to the type of yarn or fiber to be made.
2. The blended raw materials are fed into the melting and glass-refining unit.
3. The molten glass can either be made into marbles or spun directly from the melt. Originally almost all fiber glass was made into marbles. Now, however, much more processing is being done by direct melt.
4. The difference between the staple-fiber process and the continuous-filament process is in the drawing and collecting techniques. The staple-fiber process employs jets of compressed air to attenuate the molten glass into fine fiber after it passes through orifices in the base of furnaces. The compressed air drives the fibers onto a revolving drum, where they resemble a cobweb. A lubricant is applied by spraying, and the material can be collected as sliver.
5. In the continuous-filament process the fibers are drawn mechanically after being extruded through small orifices. A sizing is applied after the filaments are gathered together and are wound on a high-speed winder at a rate of over 1 mi/min.

Properties of fiber-glass fibers See Table 2.

End uses In 1970, domestic producers of glass fiber shipped 434.1 million pounds. The principal textile use for glass fiber is in multifilament form for such articles as draperies, electrical insulation, and industrial filtration cloths.

Olefin

A manufactured fiber in which the fiber-forming substance is any long-chain synthetic polymer composed of at least 85 percent by weight of ethylene, propylene, or other olefin units, except amorphous (noncrystalline) polyolefins qualifying under category (1) of Paragraph (j) of Rule 7.

History Polyethylene, the first of the olefin fibers, was introduced in 1941. Polyethylene resin was developed commercially by I.C.I. just before World War II. It was based on polymerizing ethylene at what were then very high pressures of 1,000 to 2,000 atmospheres. The low melting point of 128°C, however, has severely limited its use as a textile fiber. It is mainly made in heavy-denier monofilaments used in webbing and cordage applications.

However, the major breakthrough in the preparation of polyolefins came in 1954 with the development of organometallic catalysts by Professor Ziegler. Ziegler's work was based in part on work carried out by G. Natta and coworkers at Milan Polytechnic. The organometallic catalysts enabled polyethylene and polypropylene to be made under normal pressures. The polymerization of the polypropylene into the isostatic form provided a polyolefin with suitable fiber-forming properties. Development of polypropylene fibers started in the United States in 1957.

Raw materials and manufacturing processes Olefin fibers are products of the petroleum industry and are derived from propylene and ethylene gases. Because